NNSA
National Nuclear Security Administration
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NEWS

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NNSA Tops List of Fastest Computers in the World
*Supercomputers at NNSA Laboratories Help to Ensure the Viability of
the Nation's Nuclear Deterrent*

WASHINGTON, D.C. – Supercomputers at the Department of Energy's National Nuclear Security Administration (NNSA) hold four of the top six slots on the industry-standard TOP500 list of the world's fastest computers released today. NNSA's computers on this year's list are: BlueGene/L at Lawrence Livermore National Laboratory (LLNL) in first place, Red Storm at Sandia National Laboratories (SNL) in second place, ASC Purple at LLNL in fourth place, and Thunderbird at SNL in sixth place.

"Now fully operational, these systems are delivering on the promise of taking three-dimensional computer simulation into an exciting new domain – predictive science," Energy Department Secretary Samuel W. Bodman said. "This capability is not only important to resolving current, time-urgent questions, but it is producing results that are providing the kind of new insights that lead to ideas for additional applications."

Supercomputers are critical to NNSA's work to assess the safety and reliability of the nuclear weapons stockpile. After the United States entered a nuclear testing moratorium in 1992, the Advanced Simulation and Computing (ASC) program was developed to help secure the stockpile through computer simulation.

NNSA uses supercomputers within the science-based Stockpile Stewardship Program to compile theoretical models, experimental results, and legacy databases into an aggregated picture that weapon scientists use to assess the viability of the nation's nuclear stockpile. Computer simulations of nuclear weapons are extremely complex, requiring a tremendous collection of physics, chemistry, engineering and material science. Supercomputers are vital to NNSA's work.

"The advent of these systems is ushering in a new era of predictive simulation in high performance computing," said Thomas D'Agostino, NNSA's Deputy Administrator for Defense Programs. "Users are very excited about early results as they work toward the longer term transformation of the weapons complex."

Because of the complexity of its national security mission, NNSA is a leader in the supercomputer industry with 40 of the 308 systems in the United States. To view the full TOP500 list visit: www.top500.org/lists/2006/11. The following is more information on NNSA's supercomputers on this year's list:

BlueGene/L: BlueGene/L is a model of computational and computer efficiency, having recorded the highest sustained performance of over 200 teraflops on mission critical simulations, together with its compact size and low power consumption. BlueGene/L's (280.6 trillion floating point operations, or teraflops, performance on the TOP500 benchmark) innovative design and collaborations with IBM in optimizing code performance on its 131,072 processor is delivering on a broader range of stockpile stewardship applications than originally envisioned. In addition to materials modeling, NNSA scientists have run a variety of large turbulence and instability physics calculations on BlueGene/L that have had wider impact beyond weapons science in the areas of oceanographic and atmospheric inversions, supernovae, and inertial confinement fusion.

Red Storm: Upgraded this year, Red Storm (101.4 teraflops on the TOP500 benchmark) continues to deliver large simulations for national security. Born from collaborations between SNL and Cray, the Red Storm design became the basis for the Cray XT3 supercomputer. With impressive scalability, high computational efficiency on increasingly large data sets, scientists using these systems have relished their ability to do better science. As a computational workhorse for the ASC program, Red Storm has provided critical computational capabilities to Los Alamos National Laboratory (LANL) in meeting major milestones for NNSA.

ASC Purple: ASC Purple (75.76 teraflops on the TOP500 benchmark), a product of a multiyear collaboration between IBM and ASC, has also exceeded expectations with early delivery of milestones for stockpile stewardship. In early 2006, a joint team of scientists from LLNL and LANL performed a series of weapon simulations at unprecedented spatial resolution, using the most advanced ASC simulation software. These simulations point to phenomena not seen at lower spatial resolutions and give new insight into weapons physics. Such detailed modeling was not practical on any previous computer architecture due to time and memory constraints.

Thunderbird: The Thunderbird Linux Cluster (53.0 teraflops on the TOP500 benchmark) with 4,480 commodity compute servers linked with an Infiniband message passing interconnect was developed in collaboration with Dell and Cisco Systems. Scientists are using Thunderbird to perform a broad range of weapons simulations, including atomistic scale to device scale modeling of radiation effects on semiconductor electronics, assessing weapon response for safety in extreme thermal and impact environments, and quantifying uncertainties in weapon performance. The level of detail being modeled in these assessments was not practical without the new level of scalable capacity that Thunderbird provides.

Established by Congress in 2000, NNSA is a semi-autonomous agency within the U.S. Department of Energy responsible for enhancing national security through the military application of nuclear science. NNSA maintains and enhances the safety, security, reliability and performance of the U.S. nuclear weapons stockpile without nuclear testing; works to reduce global danger from weapons of mass destruction; provides the U.S. Navy with safe and effective nuclear propulsion; and responds to nuclear and radiological emergencies in the U.S. and abroad. Visit www.nnsa.doe.gov for more information.

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